seen on the side, with the ends of the same stylolitic columns forming the etched surfaces. A plane of stylolites may be continuous with one of the pitted surfaces. The sides of the depressions sometimes show the characteristic striations of the stylolitic columns.

So many examples show the absolute relationship and interdependence of the so-called etched surfaces and the stylolites that there can be no doubt that the two features are one and the same thing. Some solvent action has been exerted upon the surfaces because the areas between the depressions are well rounded in many specimens, but the major depressions are the result of the stylolites. Many specimens were found which still retained the usual coating of ferruginous clay.

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THE DEFINITION OF ENERGY

To the Editor of Science: Language is an arrangement of words used to express and to convey ideas—and sometimes to conceal ideas or lack of ideas. More than twenty-one years ago, when compiling my "Mechanical Engineers' Pocket-book," I wanted some language in which to convey to students an engineer's idea of energy, and with Rankine, Weisbach and other books at my side, I finally wrote the following:

> Energy, or stored work, is the capacity for performing work. It is measured by the same unit as work, that is, in foot-pounds. It may be either *potential*, as in the case of water stored in a reservoir, capable of doing work by means of a water-wheel, or *actual*, sometimes called kinetic, which is the energy of a moving body.

In the several revisions my book has undergone since 1895 I have never found any reason to change the wording of this definition. Now I find in Professor Garver's article in Science of April 21, 1916, that this definition "conflicts with facts," leads to "logical absurdities," is "defective and misleading."

Desiring to find, for the next revision of my book, the best possible language, or form of words, in which to convey the idea commonly expressed by the word "energy," that is to get the best definition of the word, I have read Professor Garver's article with great care, and I find the following:

> We are acquainted with matter only as that which may have energy communicated to it from other matter, and which may in its turn convey energy to other matter.
>
> Energy we know only as that which in all natural phenomena is continually passing from one portion of matter to another.
>
> This latter, and later, conception of energy seems, to my mind, a long step in advance over the conception of energy as the "capacity of doing work."

From these statements we may derive the following definitions:

Matter.—That which may convey energy to other matter.

Energy.—That which is continually passing from one portion of matter to another.

Matter.—That which may convey that which to other that which.

Professor Garver also says:

> There is no more necessity for a "definition" of energy than there is for a definition of "matter." Both are known only by their characteristic phenomena; and these characteristics must serve to identify them and to differentiate them from each other.

But there is a necessity for definitions of both of these terms. The users of my book demand them. Every young student demands that a technical term in a text-book be defined in words that are less technical or more elementary than the term itself. For example, I define matter as follows:

> *Matter.*—Any substance or material that can be weighed or measured. It exists in three forms: solid, liquid and gaseous. A definite portion of matter is called a body.

The language used to convey ideas of physical phenomena to students of elementary physics should begin with the simplest and most easily understood words. For example, stone, water, air, solid, liquid, gaseous. The stone, water, air have some qualities in common. They occupy space, can be measured or weighed, and can not be put in motion except

by the application of force. Anything that has these qualities is called "matter," hence the definition of matter. Lift the stone. The lifting requires the application of force. Force, a push or a pull. Resistance, a force which acts opposite to the lifting force, the force of gravity in this case. The stone weighs 10 pounds, it is lifted 5 feet against a resistance of 10 pounds. The operation of lifting or of overcoming the resistance through a distance is called work. Work is defined as the exertion of force or the overcoming of resistance through space, and is measured as the product of the force and the distance. The product of 10 pounds and 5 feet is 50 foot-pounds of work. Let the stone fall. Gravity is now the applied force and there is no opposing resistance (neglecting the slight air-resistance) until the stone reaches the earth. It acquires speed during the fall, the speed increasing at the rate of 32.2 feet per second in each second, and when it has fallen 5 feet it has attained a velocity $V = \sqrt{2gh} = 17.9$ ft. per sec.

Thus the student is led forward from the simple concepts which he already has, say at the age of 12 years, as clear as he will ever have them throughout his life, of solid, liquid, gas, distance, force, time, to the meaning of the general term "matter" and to the compound concepts work and velocity, and he is now prepared to go a step further and meet the words, stored work, energy, potential and kinetic, energy of motion, mechanical energy, and to understand the definition: Energy, or stored work, the capacity for performing work.

This definition is pedagogically sound, scientifically accurate as any definition can be, sanctioned by sixty years or more of usage by the best writers, and expressed in language that is probably as clear and satisfactory as any other that can be invented. It fits easily the energy formula $FS = \frac{1}{2}MV^2$, and when heat energy and electrical energy are studied, the doctrine of conservation of energy.

If there is any "existing confusion in the use of the word energy" it is due to modern writers who have departed from the good old definition. When they return to it the confusion will disappear.

WM. KENT

SCIENTIFIC BOOKS

The Vegetation of a Desert Mountain Range. By FORREST SHREVE. Carnegie Inst. Wash. Pub. 217. Washington, 1915. 8vo. 112 pp., 18 figs., 36 pls., 1 chart.

This book is addressed especially to workers in physiological plant ecology, but it should be valuable, also, to students of physiographic ecology and to those whose interest lies primarily in the floristic aspects of vegetations. Furthermore, all who respond to the undefinable call of deserts and mountains will sense the impulse that leads to pack-saddle and sleeping-bag, if they will but glance at the wonderfully good half-tone illustrations here brought forth. It is a little to be regretted that these plates, at the back of a rather special scientific monograph, may not reach nearly all who might derive much pleasure and profit from them. This is a characteristic of good ecological work, that it interests not only the specialist in out-of-door biology, but also nature-lovers in general and non-ecological scientists.

Perhaps the most striking general feature of the monograph lies in the fact that Shreve's presentation of his very thorough knowledge of this mountain range does not stop with pictures and descriptions, nor does it depend, for its scientific interest, upon general theories as to how the various features considered may be related. He goes much farther, and devotes more than half the book to measurements of climatological conditions and actual correlations between these and plant distribution. Realizing the fundamental importance of climatic features in determining plant activities, students of plant distribution have long wished for this sort of treatment, but only a few have thus far found the opportunities, the patience and the insight, to correlate quantitative climatic measurements with ecological observations. This publication will probably have its greatest value to ecological science in the suggestions that it offers as to quantitative methods of attack upon the vegetation-climate correlation.

The Santa Catalina range lies near Tucson, Arizona, and rises from a basal elevation of about 3,000 feet to a height of 9,150 feet, thus